USN 18PHY12

First Semester B.F. Degree Examination, Dec.2018/Jan.2019

Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. Physical constants : Velocity of light, c = 3 x 10 ^{8} m/s
Planck's constant, h = 6.63x 10 $^{-34}$.1s
Mass of electron, m $_{e}$ = 9.1 x 10^{-31} kg .
Charge of electron, e = 1.6x 10 $^{-19}$ C
Boltzmann constant = 1.38 x 10 $^{-23}$ JK^{-1}
A vagadro number = 6.02 x 10 ^{23}/mol.

Module-1

1 a. What are shock waves? Mention the characteristics and applications of shock waves. **(06 Marks)**

b. What are damped oscillations? Give the theory of damped oscillations and hence discuss the case of critical damping. **(10 Marks)**

c. A free particle is executing simple harmonic motion in a straight line with a period of 25 seconds; 5 seconds after it has crossed the equilibrium point, the velocity is found to be 0.7 m/s. Find the displacement at the end of 10 seconds and also amplitude of oscillations. **(04 Marks)**

OR

2 a. Define SHM. Mention the characteristics of SHM. Give one example of SHM. **(06 Marks)**

b. With a neat diagram, explain the construction and working of Reddy's shock tube. Mention conservation of mass energy and momentum expressions. **(10 Marks)**

c. A mass of 0.5kg causes on extension of 0.03m in a spring and the system is set for oscillations. Find i) The force constant for the spring ii) Angular frequency and iii) Time period of the resulting oscillation. **(04 Marks)**

Module-2

3 a. State and explain Hooke's law. Define elastic and plastic limits. **(06 Marks)**

b Define Young's modulus of materials. Derive an expression for the Young's modulus of a beam using single cantilever method. **(10 Marks)**

Calculate the torque required to twist a wire of length 1.5m, radius 0.0425 x 10^{-2}m through an angle of (7r/45) radians, if the value of rigidity modulus of the material is 8.3 x10 ^{10} N/m^{2}. **(04 Marks)**

OR

4 a. What is Bending moment? Mention various types of beams and their engineering applications (any four). **(06 Marks)**

b. What are the types of Elastic moduli? Derive a relation between Y, K and σ. **(10 Marks)**

c. Calculate the Force required to produce an extension of l mm in steel wire of length 2m and diameter 1 mm. (Y — 2 x 10 ^{11} Nim^{2}) **(04 Marks)**

*Min% .0 two.

Module-3

5 a. What is Numerical Aperture? Derive an expression for the same. **(06 Marks)**

b. State and explain Maxwell's equation for electromagnetic field. Starting from Maxwell's equations, deduce the wave equation for a plane wave in free space. **(10 Marks)**

c. Determine constant C, such that. A = (x + ay)a, + (y + bz)a + (x + cz)6. $_2$ is solenoidal. **(04 Marks)**

OR

6 a. Explain the types of fiber losses. **(06 Marks)**

b. State and explain Gauss Divergence theorem. Mention the Stoke's theorem. (10 **Marks)**

C. The refractive indices of core and clad are 1.50 and 1.48 respectively in an optical fiber. Find the numerical aperture and angle of acceptance.. **(04 Marks)**

Module-4

7 a. Setup one dimensional time independent Schrodinger wave equation. **(06 Marks)**

b. Mention the three modes of vibration in CO_2 molecule. With neat diagrams explain the construction and working of CO2 laser. **(10 Marks)**

c. A pulsed laser emits photons of wavelength 780nm with 20mW average power/pulse. Calculate the number of photons contained in each pulse if the pulse duration is lOns. **(04 Marks)**

OR

8 a. Prove that electron cannot exist inside the Nucleus of an atom. **(06 Marks)**

b. Derive an expression for energy density in terms of Einstein's coefficients. **(10 Marks)**

c. An electron is bound in a one dimensional potential well of widthlA , but infinite wall height. Find its energy values in the ground state and in the first two excited stat es. **(04** Marks)

Module-5

9 a. What are the assumptions of Quantum Free Electron Theory (QFET)? Explain the merits o QFET. **(06 Marks)**

b. What is Hall Effect? Derive an expression for Hall voltage interms of Hall coefficient, **(10 Marks)**

c. Find the temperature of which there is probability that a state with an energy 0.5eV above the Fermi energy is occupied. **(04 Marks)**

OR

10 a. What is polarization? Explain various types of polarizations mechanisms. **(06 Marks)**

b. What is Fermi Energy? Derive an expression for Fermi Energy at zero Kelvin for a metal. (10 **Marks)**

e. The resistivity of intrinsic germanium at 27°C is equal to 0.47 ohm-m. Assuming the electron and hole mobilities as 0.38 and 0.18 m^2/V-Sec respectively. Calculate the intrinsic carrier density. **(04 Marks)**